

**APPENDIX – D**

**CONFINED SPACE ENTRY POLICY**

**BUREAU OF DESIGN AND ENVIRONMENT**

**SURVEY MANUAL**

May 2001

**21.6 ILLINOIS DEPARTMENT OF TRANSPORTATION  
CONFINED SPACE ENTRY POLICY**

Developed by the  
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## INTRODUCTION

One of the most potentially hazardous situations in highway operations is entry into a confined space. The following are some types of confined spaces but is not all inclusive: man-holes, sewers, pipes, lift stations, some bridge superstructures, sub structures, coffer dams, underground utility vaults, wet wells and storage tanks. The hazard is that the atmosphere being entered can be contaminated with either flammable or toxic gases, or is deficient in oxygen. While this work procedure deals with a planned entry, the sections on atmosphere testing and use of self contained breathing apparatus will be helpful for emergency entry into a confined space. Dangerous contaminants sometimes found in confined spaces may be grouped as follows:

1. Fuel gases—such as manufactured gas, natural gas, or liquefied petroleum gases;
2. Vapors of liquid fuels and solvents—such as naphtha, gasoline, kerosene, benzene, and other hydrocarbons;
3. Gases from fermentation of organic matter—such as methane, carbon dioxide, hydrogen, hydrogen sulfide, and mixtures deficient in oxygen;
4. Products of combustion—such as carbon dioxide or carbon monoxide from engine exhaust;
5. Gases and volatile substances within industrial drainage;
6. Gases formed after sewer explosions and fires;
7. Gases from the use of nitro explosives.

Because mixtures of these contaminants are not uncommon, explosion, fire, and asphyxiation hazards may all be encountered in the same confined space. Hazardous atmospheres encountered underground can, therefore, be classified as flammable, poisonous, or suffocating.

The explosion hazard of flammable gases is generally under-stood. However, it is important to keep in mind that such gases are combustible throughout a range of air mixtures, which start at the lower explosive (flammable) limit (LEL) with just enough gas present to support combustion and range upward to the upper explosive (flammable) limit (UEL), above which there is no longer enough air for combustion. This LEL-UEL range (in percent by volume) varies with the gas, and those having a wide range, such as hydrogen, are the most hazardous. Because the usual portable combustible gas indicators do not differentiate between gases—they indicate only relative combustibility and show how the sample compares with a suitable standard—the precautions described here pertain to all flammable gases.

Poisonous gases, some of which have no odor, can be fatal in very low concentrations in air. Carbon monoxide can be fatal at 1/10 of one percent, and it is dangerous at even 1/50 of one percent, because it accumulates in the body with continued exposure. Certain types of poisonous gases, such as hydrogen sulfide, have paralyzing effects on the sense of smell after initial exposure. This makes fatal concentrations undetectable

by their odor. Therefore, prescribed testing methods are the only safe precaution.

The presence of suffocation gases or vapors may result in oxygen deficiency—a concentration below the minimum necessary to support life. Normal air has 21 percent oxygen. Although 16 percent is considered the minimum concentration of oxygen to support life, OSHA has established 19.5 percent as the safe minimum concentration for working in confined space.

Although there are gases that are lighter than air, many vapors are heavier, such as butane, propane, and other hydrocarbons. Such gases remain in ground depressions and flow into low points such as underground structures, where they create a hazard that is difficult to remove. Other gases, generated by decaying vegetation or animal matter, find their way into manholes. Such gases are usually high in carbon dioxide, low in oxygen, and contain varying amounts of methane. Some, like hydrogen sulfide, may become combustible when more air is introduced to form a combustible mixture. They are dangerous primarily because they lack sufficient oxygen to support life. Oxygen deficiency may also be caused by oxidation of metals or other materials in damp, enclosed areas, or by the dilution or displacement of air by other gases.

## **SAFETY POLICY - CONFINED SPACE**

The Illinois Department of Transportation recognizes that a program for safe working conditions has to be a partnership arrangement between management and employees. Management's responsibility is to be aware of all known safety hazards and to provide employees with suitable safety equipment and training. Each employee must also be committed to personal and co-worker safety. IDOT management will require each employee to observe and practice the safety procedures as instructed. Safety only works if it is practiced day in and day out by all parties concerned.

Each District/Bureau performing work in or around a confined space shall assign a person to serve as a safety and health liaison. This person shall be responsible for maintaining a central point for all records relating to confined space training, confined space inventories and confined space entry permits. This person shall be qualified and competent in confined space entries.

## **EMPLOYEE SAFETY RESPONSIBILITIES**

- A.** Follow all safety rules and regulations established for the job.
- B.** Wear proper safety equipment required for the job.
- C.** Report all unsafe conditions to the supervisor.
- D.** Report all injuries.
- E.** Inform co-workers if performance is unsafe.
- F.** If the entry into a confined space is questionable at any time from a safety standpoint, notify the supervisor immediately. Do not enter a confined space that is not safe.

**PRE-ENTRY CERTIFICATION**

Once a problem is encountered in a confined space, it is quite likely that the problem will persist in the future. Therefore, it is good to have knowledge of those confined spaces that have had hazardous atmospheres.

Prior to making an entry into a confined space, a permit shall be completed. The permit shall give the location of the con-fined space, reason for entering, names of workers involved, and results of atmosphere testing. The permit shall be given to your supervisor. [\(See example permit form on page D-9.\)](#)

**SAFETY PROCEDURES****A. Setting Up The Vehicles In Traffic For Access to a Confined Space**

When required before positioning vehicle, be sure to follow all current traffic control policy.

- a) Everyone must be wearing hard hats, orange vests, approved steel-toed shoes and additional required personal protection equipment as determined by the competent person.
- b) Extinguish all cigarettes. No smoking while positioning equipment, or in general area.

**B. Testing Confined Space Atmosphere**

Before workers are allowed to open and enter manhole structures or other confined spaces, the structures/spaces shall first be tested for oxygen concentrations, flammable and non-flammable gases, toxic vapors, hydrogen sulfide and other potential hazardous atmospheric conditions that reasonably may exist. The test results shall be used to determine ventilation and respiratory protection requirements. Sound testing procedures must be utilized.

**All confined spaces shall be power ventilated at all times people are in the confined space.**

All personnel entering a manhole or other confined space shall wear appropriate class III safety harness and life lines for quick removal in case of an emergency. The safety harness and life lines shall be so attached that the body cannot be jammed in an exit opening. At least two (one of which shall be the attendant and the other near by) workers shall remain on the surface in such a position that they can observe and assist in the removal of those in the manhole. A hoisting and/or retrieval device will be in place at all such locations.

Employees entering the confined space shall wear the gas/oxygen monitoring equipment and continuously monitor the atmosphere during the entire time in the confined space. If the gas monitor indicates an unsafe atmosphere, vacate space

immediately, contact your supervisor and take steps to ventilate the confined space, identify source of the problem, and do not re-enter the space until the atmosphere is clear.

### C. Communication/Inventory

Communications (visual, voice or signal line) shall be maintained between both or all individuals present.

Inventory: Each district shall maintain a current inventory of the following:

- Confined space types
- Confined space equipment, including ventilatory, hoist, winch, harness, lanyards, tripods, testing equipment, rescue equipment.

### D. Confined Space Ventilation

1. Even when all atmosphere tests are within allowable limits, the confined space shall be purged with a power blower with a fresh supply of air for at least five (5) changes of air and continuously ventilated with a powered ventilator while employees are in the confined space.
2. The atmosphere shall be continuously monitored while it is occupied by employees.
3. If gases are found or an oxygen deficiency exists, the following procedures shall be implemented:
  - (a) For oxygen deficiency, ventilate for five (5) air changes and complete a new series of atmosphere tests again. **Do not enter an atmosphere that tests below 19.5% o2 by volume.** If you cannot get a safe (19.5%) reading, close the space and contact your supervisor. Fifteen shall be the minimum ventilation time.
  - (b) If gases are detected, purge the confined space until you get a zero reading. You shall continuously monitor the atmosphere. At any time the concentrations exceed 20% LEL, cease operations and vacate the space. Close the space and advise the supervisor.
4. Blowers should be located so there are no unnecessary bends in the hose. One 90 degree bend reduces the blower capacity to 70% of rated capacity. Two 90 degree bends reduce capacity to 50% or 1/2. Three 90 degree bends reduce to 1/3 of capacity. Each additional hose length to equal one 90 degree bend. When the output of the blower capacity is reduced to below 300 CFM, a larger or additional blower should be used. For continuous ventilation with people in a manhole, a blower of at least 500 CFM shall be used. (Gas + oxygen tests shall be made continuously, no matter how "clean" the confined space seems to be). Blowers shall be located so they will not pick up exhaust gases from vehicles, heaters, furnaces or the blower engine. They shall not ingest fuel vapors, e.g., gasoline, propane, etc. The blowers should operate for 1 minute, to flush out the hose, prior to placing it in the manhole. Air should be tempered from temperature extremes. The blowers shall meet NFPA requirements to prevent ignition hazard.

**E. Lowering Equipment**

1. Never drop anything down.
2. Lower small items in a bucket.
3. Large items such as hoses and crowbars must be securely tied before lowering.
4. Always announce before lowering anything.
5. The person below should never look up while something is being lowered. Stand to one side of the confined space and reach above to grab lowered items.

**F. Hazardous Situations**

1. Under hazardous conditions, employees working in con-fined spaces shall wear life lines, and at least two workers should be positioned at the surface where they can see or hear those in the confined space. They should also be properly equipped with hoisting equipment and trained to render assistance in case of an emergency.
2. If the worker in the confined space loses consciousness and the observer must enter the confined space, the observer shall use a self-contained breathing apparatus.
3. Remove the unconscious worker as quickly as possible.
4. Do not try to give the unconscious worker air from your breathing apparatus. If a spare breathing apparatus is available, use it.

**G. Fall Protection**

Where a potential exists for persons or objects falling into a confined space, warning systems, or barricades shall be employed at the entrance.

**H. Fall Arresting Systems**

Fall arresting systems shall be worn by personnel entering confined spaces as determined by a qualified person.

**I. Confined Space Entry Equipment**

The following is a list mandating equipment that shall be available at the confined space:

1. Atmosphere Tester (flammability, toxicity, hydrogen sulfide, and oxygen) calibrated at least every six months and at least annually by certified personnel
2. Self-contained Breathing Apparatus
3. Full Body Harness
4. Hoist
5. Hard Hat

6. Rope (life line)
7. Ventilator/Blower
8. Tripods

#### **J. Training**

1. General requirements. Personnel responsible for supervising, planning, entering or participating in confined space entry and rescue shall be adequately trained annually in their functional duties prior to any confined space entry.

Training shall include:

- An explanation of the general hazards associated with confined spaces.
  - A discussion of specific confined space hazards associated with the facility, location, or operation.
  - The reason for, proper use, and limitations of personal protective equipment and other safety equipment required for entry into confined spaces.
2. All personnel required to work/or enter a confined space shall be trained annually in the Department's Policy, Emergency Procedures.

#### **K. Emergency Response Plan**

1. A plan of action shall be written with provisions to conduct a timely rescue for individuals in a confined space should an emergency arise. Included in these provisions shall be:
  - Determination of what methods of rescue must be implemented to retrieve individuals.
  - Designation of rescue personnel that are immediately available where PCR entries are conducted.
  - Type and availability of equipment needed to rescue individuals.
  - An effective means to summon rescuers in a timely manner.
  - Hands on training and drill of the attendant and rescue personnel in preplanning, rescue and emergency procedures annually.
2. Breathing equipment. All rescue personnel must use self-contained breathing apparatus/SCBA breathing equipment, when entering the confined space to rescue victims.
  - If it is established that the cause of the emergency is not a hazardous atmosphere, rescue breathing equipment is not required.
3. Rescue equipment inspection. All rescue equipment shall be inspected periodically by a qualified person and prior to start of work to ensure that it is operable.



**L. Hazardous Warning**

1. Contractors. Bureaus that use contractors to enter confined spaces shall inform contractors of known potential hazards associated with the confined space to be entered.
2. Identification of rescue responder. The bureau and contractor shall establish who will serve as the rescue responder in an emergency and what systems will be used to notify the responder that an emergency exists.

These are the minimum recommended requirements. Additional needs should be developed by local management to meet local needs and comply with appropriate Illinois Department of Labor Standards. All personnel that may be required to use a SCBA shall meet and comply with IDOT respirator policy.

Variances to this policy will be evaluated by the Employee Safety Unit on an individual basis upon receipt of a written report.

**PRE-ENTRY CERTIFICATION REPORT**

Report is required for entering any confined space for any purpose prior to entry:

Date: \_\_\_\_\_ Time \_\_\_\_\_ am/pm

Location: \_\_\_\_\_

Equipment: \_\_\_\_\_

Purpose: \_\_\_\_\_

Employees entering confined space:

1. \_\_\_\_\_ 2. \_\_\_\_\_

3. \_\_\_\_\_ 4. \_\_\_\_\_

Stand-by Observers: 1. \_\_\_\_\_

2. \_\_\_\_\_

1. Atmosphere tested for flammable concentration:

Time: \_\_\_\_\_ By: \_\_\_\_\_ (init)

2. Test for toxic atmosphere: ppm of: Time: \_\_\_\_\_ By: \_\_\_\_\_ (init)

3. Test for oxygen content: Reading: \_\_\_\_\_ % By: \_\_\_\_\_ (init)

4. Surrounding area checked for flammability and toxic gases:

Time: \_\_\_\_\_ By: \_\_\_\_\_ (init)

5. If a hazardous condition was encountered, what did you do to remove or compensate for the condition?:

5. Recommended improvements for safety:

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Approved by: \_\_\_\_\_ (qualified person)

**INSTRUCTIONS FOR  
PRE-ENTRY CERTIFICATION REPORT**

The "Pre-Entry Certification Report" shall be completed in duplicate by a qualified person immediately prior to entry into the confined space. The original shall be kept at the worksite while the work is being conducted. Following completion of the work or expiration of this report, the original shall be kept on file with the unit performing the work and a copy kept on file with the district's safety and health liaison.

- A. "Pre-Entry Certification Report" shall only be valid from the time the confined space is entered until it is closed, but shall not exceed 7.5 hours or one work shift.